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WOOLLY APHID OF ELM AND JUNEBERRY

CONTENTS.

This Bulletin contains an account of the common aphid forming leaf curl of the American Elm; and records the migration of this pest to the Juneberry.

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BULLETIN 241.

WOOLLY APHID OF ELM AND JUNEBERRY.*

(*Schizoneura americana* in part, of authors.)

EDITH M. PATCH.

Each season considerable concern is expressed by residents of Maine relative to certain deformations of elm leaves due to the work of aphids. Indeed so unattractive do young elms appear when heavily infested that it sometimes seems desirable to the owners to remove them from the lawn.

Several species cause distortions of these leaves, one of which is treated in this paper in such a manner as to outline the chief points in its life cycle.

Familiar to all observers of the American Elm are leaves one edge of which is rolled under as is shown in Figure 45. Such a curl constitutes a protective habitation for a family of aphids during their spring residence there.

The mother of the colony is a large plump, somewhat powdery aphid which, if examined in the sunlight under a lens, is found to have a greenish complexion. She passes the winter in the egg stage hidden in the crevices of the elm bark. In the spring, hatching from the egg just as the leaves are unfolding, she seeks a suitable one, punctures it with her beak and by remaining and feeding causes it to curl into the protecting roll. Early in June she has attained her full growth and the leaf in which she has been dwelling looks like the left hand leaf of Figure 45. She now gives birth to a large number of young, which, unlike their mother are born alive, not undergoing any external egg stage.

Her progeny are all females which upon attaining their growth give birth in turn to living young,—also all females.

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*Papers from the Maine Agricultural Experiment Station: Entomology No. 79.

All the descendants of the original aphid or "stem-mother" as she is called, ordinarily remain in the same leaf and the curl becomes swollen and crowded with the numerous family. As each individual casts its skin several times in the process of its growth and as the discharge of honey dew is abundant, the curl after a time has a considerable amount of waste matter which causes it to look untidy within. Conditions are kept remarkably sanitary, however, by the aid of the waxy secretions of the aphids, particles of which cover the honey dew so that it rolls about in liquid pellets without drenching their bodies. These insects are further protected by the white waxy secretions which remain upon them rendering them impervious to moisture.

The earlier members of the family, including the stem-mother, are all wingless. Late in June, however, a generation matures with wings.

These winged individuals, or "spring migrants" as they are called, resemble the wingless generations previously mentioned in being all females, but they are smaller bodied and differ in various structures. Instead of remaining within the leaf with their wingless relatives these later forms take flight, seeking fresh vegetation for the establishment of the summer colonies. They are strong on the wing and fly to distances of at least three-fourths of a mile if they do not find a suitable location near at hand. When they desert the elm leaf which has furnished sap for their development they are "instinctively" led to an entirely different habitat, namely the Juneberry (*Amelanchier*) so common in Maine and variously known as Shad Bush, Service Berry, and locally as Sugar Plum.

When the migrant reaches one of these bushes it settles upon a leaf and soon afterward creeps to the underside where it remains quietly, ordinarily for the rest of its life. Before many hours it begins to give birth to young and continues this process for several days. The wee aphids, born on the underside of the Juneberry leaf, cling there for a little while without feeding and then walk down the stem of the plant. Sometimes a line of these can be seen trailing down "Indian file."—little pellucid yellow specks so small that the observer almost requires a lens to detect them at all. The destination of these minute young is the underground stems of the Juneberry, where they settle in groups at some tender spot.

This, then, is the destined summer residence of the insect;—the little thing whose mother, grandmother and great grandmother grew up in the curl of a high swinging elm leaf, creeps under ground and sips Juneberry sap in the dark.

There is, perhaps, no bird migration more remarkable than the flight of a migratory aphid and the histories of many species of this family of insects have the thrill of a dramatic tale of adventure.

The summer colonies of our aphid of elm and Juneberry, like their spring antecedents, are composed only of females, the first generation being wingless and the body whitened by the secretions of the wax glands.

In the fall a generation of winged females is developed among the underground forms. These are the fall migrants and in appearance they are practically like the spring migrants. These leave the Juneberry and take flight to some American Elm.

Alighting on the bark, they seek a convenient crevice and give birth to minute young, part of which are egg-laying females and part males,—this being the only time in the life cycle of this insect that either of these forms appear. These tiny "true sexes" have no functional mouth parts,—their chapter in the life history being concerned merely with mating and providing for the deposition of the overwintering egg. Each female lays but a single egg which nearly fills her small body.

The egg is the closing page of the life cycle for the fall, and the opening one for the spring; because it is from this overwintering egg that the stem-mother hatches at the time of the bursting leaf buds, in season to form the curl of the elm leaf for the spring habitation used by her and her numerous progeny.

Natural Enemies.

There are several predaceous insects which frequent the elm leaf curls of this aphid. In Maine the most common ones are a capsid (*Camptobrochis nitens*), the flocculent larva of a coccinellid, and syrphus maggots. Some years these greatly reduce the numbers of this elm pest.

Preventive and Remedial Measures.

In a state where both elms and Juneberries abound as they do in Maine, we must expect this aphid to occur both in the curl of the leaves of the former and on the underground stems of the latter.

FIG. 45. Work of *S. americana* in part of authors: at left young roll containing stem female; at right, same species, old roll just deserted by migrants. Maine specimens.

Where the *Amelanchier* is planted for park or ornamental purposes within aphid flight of American Elm, it would seem desirable to try drenching the soil at the base of the shrub with Black Leaf 40 or other good tobacco decoction. Probably once about mid-July and again late in the month would be the most favorable time for this treatment as the colonies would be young and susceptible and likely to be nearer the surface than later in the season.

Young elms can be protected by spring sprays of tobacco decoction before the leaves become curled. Where large power sprayers are available old elms sprayed with drive nozzles could probably be cleaned of most of the infestation.

Dormant sprays of lime sulphur heavily coating the elm bark should be tested as to their efficiency in killing the over-wintering egg.

Notes.

The species discussed in this paper under the title "Woolly Aphid of Elm and Juneberry" is the same species which is listed as CCC in the Habitat Key on page 184 of Bulletin No. 217 of this Station, and recorded on pages 268-271 of Bulletin No. 220.

As the alternate or summer host of this species has not previously been published, it seems desirable to state here the data upon which this life cycle is recorded.

On June 28, 1911, a collection of winged forms of this species from *Amelanchier canadensis* (L.) Medic. was made by Mr. William Woods and mounted by my assistant under the number 15-11. As *Prociphilus corrugatans* is commonly taking flight from the leaves of Juneberry late in June, I took it for granted that 15-11 was probably that species and did not examine the material until 1914 when I was startled to find that all this collection was *Schizoneura americana* of the elm leaf curl.

No additional data were obtained last year but on June 25, 1915, Mr. Woods brought into the laboratory about 30 migrants stating that they were abundant and occurring singly on the underside of the Juneberry leaves. Upon examination, I found these to be *Schizoneura americana* and as they had been collected about three-fourths of a mile from the nearest known elm, the situation was given immediate attention. I visited the place in the college woods where Mr. Woods had made his collection (50-15) and found the migrants resting upon the underside of the leaves of almost all of the numerous Juneberries in that vicinity, and did not find them settling upon other vegetation there. Upon some of the Juneberry leaves the minute yellowish young of the migrants were found, and it was an easy matter to locate on the underground stems of these shrubs, the colonies of young, already grouped about some favorable spot and covered by a slight waxy secretion.

Three young Juneberries were potted and brought into the laboratory. Migrants were removed from elm curl and caged with these plants. They settled on the ventral side of the leaves and remained there several days giving birth to their young which sought the underground stem of

the accepted plant. Of course, since these plants were taken from the open, there was every possibility that their roots might have been infested also in the field. But fortunately one of the three plants was kept moist under glass and upon this the progeny of the migrants colonized on the stem well above ground where there was no danger of their being confused with field material. Some of the colony were still alive 14 days later, but they did not thrive as did the underground settlements.

On Checkerberry Hill near Orono a solitary Juneberry not more than eighteen inches high was found with several migrants on the underside of its leaves. As this plant was about three-quarters of a mile from the nearest known elm, the record is interesting.

June 28, near Orono, 415 of these migrants were counted resting on the under surface of leaves of a single large Juneberry situated between two large elms. This number was only a part of the migrants present as those on the upper leaves could not be counted from the ground.

During the week of June 27, I spent parts of several days watching some small Juneberries on the river bank ledges near Orono. The migrants from elm were present and others alighted every now and then. I saw their young trailing down the stem toward the ground, and found colonies on the underground stems here as in the college woods.

For the most part but one migrant occurred on a leaf, but where leaf curls removed from elm were placed under caged Juneberries on the ledge, as many as 16 migrants were found on the ventral surface of a single leaf. Four other kinds of plants chanced to be under the same cage and it was interesting to record that not a single migrant was found on the under surface of the leaves of any of these. One was observed walking restlessly across the top of a goldenrod leaf, but it did not remain there.

As will be seen from the date of the publication, this paper goes to press before the fall migrants are collected from Juneberry; and the statement in the life history account that the fall migration to the elm is from Juneberry is based only upon what seems to be the inevitable sequel to the behavior of the spring migrants and their progeny on the Juneberry. Knowing the summer host and that migrants seek the elm in the fall, the circumstantial evidence seems logically sufficient.

The observation here recorded open up an interesting series of questions in regard to this widely distributed elm leaf species. Does this insect occur on the elm only where that tree is within aphid flight of *Amelanchier*? If not, what summer host is accepted for such localities? Are there circumstances where the elm, alone, is able to provide for a continuation of this species? Does it occur on the roots of trees or shrubs botanically related to the Juneberry and has it in such circumstances ever been confused with *lanigera*?

In connection with the last question it might be stated that the wax gland areas of the summer root forms are different from those of *lanigera* and would doubtless serve as a sufficient means of separating

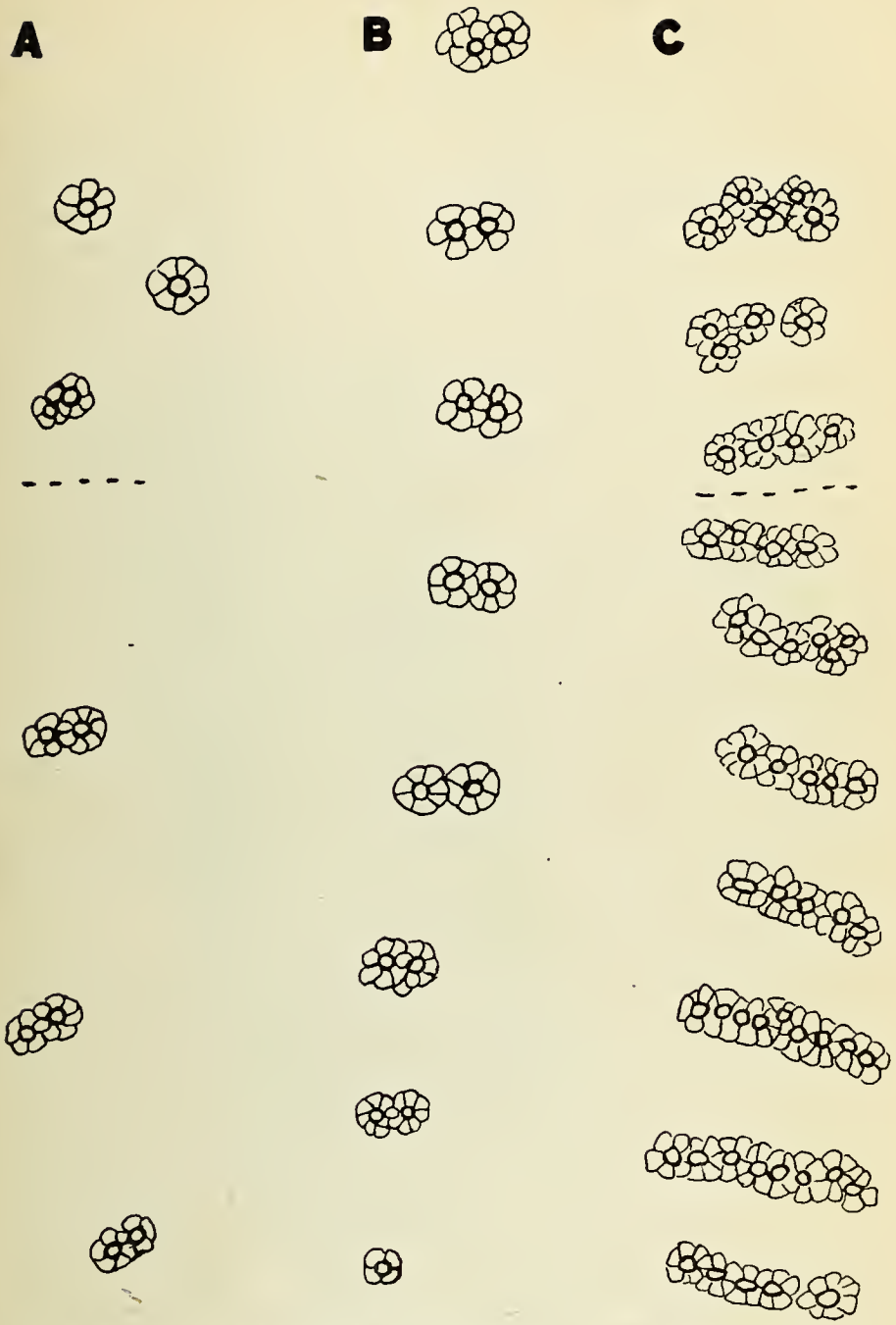

Fig. 46. Wax gland areas of nymphs of *S. americana* taken from underground stem of Juneberry, July 13, 1915. A. and B., those of one of the two dorsal lines. A, from head and thorax. B, from abdomen. C, lateral wax glands of thorax and abdomen.

these two species should they ever be found to occur upon the roots of the same trees.

Schizoneura americana is a name which until recently has been commonly applied to two distinct species by American entomologists.

One of these species inhabits the leaf cluster or aphid rosette of the American Elm.* This migrates to apple, several varieties of mountain ash (*Pyrus sp.*) and to hawthorn (*Crataegus*), where it was familiar as *lanigera* long before its identity with the aphid of the elm rosette was suspected. The life cycle of this species so far as personally ascertained by the writer is recorded in Bulletin No. 217 of this Station. The admirable publication by Mr. A. C. Baker should be consulted by everyone studying this insect. (1915. The Woolly Apple Aphis. Report No. 101, U. S. Dept. Agric. Office of the Secretary).

The other species to which the name *Schizoneura americana* has been commonly applied is the aphid discussed in this present paper. Since the name *lanigera* takes care of the rosette species on elm as well as on apple, *S. americana* seems to be left free for the aphid curling or rolling the leaf of the American Elm. Riley's description of the leaf deformations caused by *S. americana*† seem to indicate clearly enough that he originally applied this name to both these species as his successors have certainly done until recently; and the synonomy "*schizoneura lanigera* (*americana* in part, of authors)," correctly designates the "rosette aphid" of the elm.

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The writer has observed and previously recorded migrants from leaf curl upon mountain ash (*Pyrus sp.*) in company with those from the rosette. The mountain ash concerned with that record was very near elms and whether the presence of leaf curl migrants upon that tree was accidental or whether their progeny will accept its roots as they do those of the Juneberry still remains to be ascertained.

The writer's first announcement of the migration of *lanigera* from elm to apple (Science Vol. 36, pp. 30-31) was a record of migrants from elm leaf curl establishing a successful colony upon apple seedlings. From the fact that subsequent successful migrations to apple have been from rosettes and not curls, there seems to be a possibility that rosette migrants may have been present accidentally in the curls which were collected in the South and sent to Maine, and that they were really the progenitors of the successful colony. Where curls and rosettes are present on the same tree such a mixture of the winged forms sometimes happens. Whether some southern elms support normally an elm curl form of *lanigera* or whether that initial record will stand as unique and without subsequent verification as to the type of the deformation concerned, remains to be seen.

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* Figs. 70 and 71, Bulletin 217, Maine Agric. Exp. Sta.

† "Curling and gnarling the leaves of the White Elm (*Ulmus americana*), forming thereby a sort of pseudo-gall. The curl made by a single stem-mother in the spring takes the pretty constant form of a rather wrinkled roll of one side of the young leaf, but, according as there is more than one stem-mother, or as several contiguous leaves are affected, the deformation assumes various distorted shapes, sometimes involving quite large masses of the leaves."